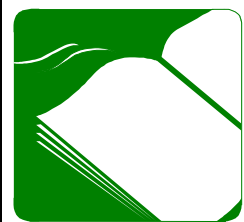


## Section 9: Cost-Effectiveness



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**Cost-Effective Projects**

The Stafford Act and its implementing regulations require that HMGP projects be cost-effective (44 CFR 206.434(b)). A benefit-cost analysis should be performed in order to determine how the anticipated value of the project compares to the cost.



44 CFR 206.434(b)

**Who Does the Analysis?**

FEMA encourages States to do benefit-cost analyses of projects they submit for funding. Otherwise FEMA staff will complete it. Managing States generally always conduct the analyses. When States submit benefit-cost analyses with projects, FEMA may verify the results using its software.

**Guidance on Cost-Effectiveness Review**

This section describes the benefit-cost model used by FEMA to determine the cost-effectiveness of a hazard mitigation project, and discusses the documentation applicants should include when submitting an application to the State for review.

**What “Cost-Effective” Means**

For HMGP projects to be considered cost-effective, a project has to return more money over its life than it cost initially. The “return” is money saved because a mitigation project reduces or prevents damages from a flood, hurricane, earthquake, or other natural hazard event.

According to 44 CFR 206.434(b)(5)(ii) to be eligible for a grant, projects must “not cost more than the anticipated value of the reduction in both direct damages and subsequent negative impacts to the area if future disasters were to occur. Both costs and benefits will be computed on a net present value basis.”



44 CFR  
206.434(b)(5)(ii)

**Net Present Value**

Net present value is the total value of benefits over a project’s life, discounted at a rate given to FEMA by the Office of Management and Budget (OMB). Inflation and investment value are two factors that demonstrate the standard economic principle that a \$1 benefit received in the future is not the same as a \$1 benefit received today. The State or FEMA use this method to determine net present value.

**Guidance and Discount Rates for Benefit-Cost Analysis of Federal Programs**

OMB directs most Federal agencies on how to determine cost-effectiveness for their programs. OMB Circular A-94, [Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs](#), is the guidance FEMA is required to use in this area. Circular A-94 describes the economic principles and methods by which most Federal programs, including the HMGP, must analyze and verify the cost-effectiveness of projects they fund.

## Thorough Assessment

In nearly all cases it is necessary to do a benefit-cost analysis as part of the eligibility determination. The process of assessing cost-effectiveness is not only required, but is also a good way to get an overall understanding of the project being evaluated. Nearly all aspects of a project—from the risks it seeks to mitigate (the benefits), to its costs, to its performance—must be recognized and quantified as part of a benefit-cost analysis.

The FEMA publication [How To Determine Cost-Effectiveness of Hazard Mitigation Projects](#) (often called “the yellow book,”) suggests a series of 10 questions as precursors to doing an analysis. Responding to the questions gives a “snapshot” of the proposed project, and so is a worthwhile exercise before starting an analysis.

## Potential Projects Requiring No Benefit-Cost Analysis

Projects that are submitted as 5% Initiative projects do not require a quantitative analysis. The contents of the narrative statement will include:

1. Identification of expected mitigation benefits;
2. Approximate value of benefits, if possible; and
3. Description of why State and applicant expect that the project will likely reduce future disaster losses.

See Section 7 for further detail on 5% Initiative projects.

Additionally, the acquisition and demolition of substantially damaged structures from the Special Flood Hazard Area requires no benefit-cost analysis.

## How FEMA and States Determine Cost-Effectiveness

FEMA has developed a set of eight computer programs as a tool to determine cost-effectiveness by doing benefit-cost analysis for projects that mitigate effects of natural hazards. While each of the modules is tailored to a particular type of mitigation project, they all use established risk modeling and economic principles as the basis for calculating the benefits of a project and comparing these to its costs.

Contact your FEMA regional office for information about these computer modules:

- Riverine Very Limited Data (VLD) Module
- Riverine Limited Data (LD) Module
- Riverine Full Data (FD) Module
- Hurricane Wind Module
- Coastal A-Zone Module
- Coastal V-Zone Module
- Earthquake Module
- Earthquake Limited Data (LD) Module

## How FEMA and States Determine Cost-Effectiveness (Continued)

States using the riverine module may select the version that is most appropriate, based on the data that is available.

These modules and related technical manuals are available from FEMA free of charge. States will find it easiest to use the FEMA software when doing benefit-cost analyses. Training is available in the use of the modules.

The following information describes generally how modules are used. Refer to the benefit-cost guidance and training for more detail.

Each of the eight FEMA computer modules incorporates established economic principles, OMB guidance, and risk calculations to determine the benefits of a project over its expected life. These benefits (which are avoided losses) are expressed in dollars so they can be compared with project costs.

If the benefits (discounted to present-day dollars; see discussion of “Net Present Value” above) exceed the costs, the project is cost-effective. The comparison of benefits to costs is expressed as a ratio. The total benefits are divided by the total costs; if the resulting ratio is greater than 1.0, the project is cost-effective (see box below). Another way to state this is that the ratio is the dollar amount of benefits that the project returns over its life for each dollar spent initially.

$(\text{Benefits}) \div (\text{Costs}) = \text{Benefit-to-Cost Ratio}$

For example:  $\$225,000 \div \$150,000 = 1.5$

$\frac{\text{Benefits} = 225,000}{\text{Costs} = 150,000} = 1.5$       Benefit-Cost Ratio

States may use other programs or mechanisms to analyze projects. Such a methodology must be consistent with the FEMA model and be approved in advance by FEMA.

## Benefits and Costs

As the term “benefit-cost analysis” suggests, you need both of these numbers to assess cost-effectiveness and get a ratio.

### Benefits

Of all the information needed for benefit-cost analysis, benefits are the most difficult to determine and quantify. The benefits of a mitigation project are avoided damages and losses that would happen in the future, so regardless of which module the analyst is using, the benefits are a prediction. The description of a benefit provided in OMB Circular A-94 is presented in the following paragraph.

A complete analysis includes comprehensive estimates of the expected benefits and costs to society. Social net benefits, and not the benefits and costs to the Federal Government, are the basis for evaluating government programs or policies that have effects on private citizens or other levels of government. Social net benefits in the context of HMGP are defined as prevented damages, loss, or emergency protection costs. Social net benefits do not include recreational or economic benefits unrelated to the hazard mitigation objectives of HMGP.

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### **Direct Benefits**

It isn't possible to make a list of every benefit that could be included in an analysis. Circular A-94 specifies that benefits must be "direct." In the case of a mitigation project, this means that there has to be a clear cause-and-effect relationship between the natural hazard and the damage or loss. Some examples of types of direct benefits include avoided:

- Building damages;
- Loss of, or damage to, personal property or building contents;
- Infrastructure damages;
- Displacement costs after a disaster event;
- Temporary relocation costs due to a disaster event;
- Casualties;
- Loss of function: Critical public facilities;
- Transportation routes;
- Electric power (industry studies of the costs of such events exist);
- Businesses; and
- Emergency protective measures.

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### **Indirect Benefits Not Included**

Some benefits may not be considered when determining the benefits of a mitigation project. Damages and losses are not included in the analysis when there is no clear cause and effect between the event (flood, earthquake, etc.) and the damages or loss. While it's not possible to list all possible indirect benefits, some include:

- Lost wages;
- Looting;
- Gross or region-wide economic effects; and
- Recreation opportunities lost or gained.

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### **Costs**

The costs of a project are generally easier to determine than the benefits. Costs are usually provided by the applicant as part of the application. If the applicant hasn't provided this information, there are many sources and means of getting it; these obviously differ depending on the kind of project being considered. The State reviews project costs for reasonableness.

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### **Data Necessary**

Different types of projects require specific data collection. This includes economic information as well as environmental and engineering data. Often, these data are missing or limited, and will impact your choice of benefit-cost analysis module. See Job Aid 9-1 for key data needed for analyzing project applications.



**Job Aid 9-1**

**Learning More  
About Benefit-  
Cost Analysis**

There are various resources available to learn more about benefit-cost analysis. These include:

- “How to Determine the Cost Effectiveness of Hazard Mitigation Projects (12/96). Also known as The Yellow Book.
- “Benefit-Cost Analysis of Hazard Mitigation Projects: Introduction to Benefit-Cost Programs” (12/96). These are the technical manuals for Full Data.
- OMB Circular No. A-94 “Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs.”
- Marshall and Swift’s, “Residential Cost Handbook.”
- R.S. Means, “Square Foot Building Costs.”

Please contact your FEMA regional office to obtain the Yellow Book and the technical manuals. The OMB Circular can be obtained from the Office of Management and Budget. The “Residential Cost Handbook” and “R.S. Means” are available in many public libraries and most engineering and architectural firms.

FEMA offers training to States on benefit-cost analysis. Please contact your regional office for availability.



Job Aid 9-1

### Key Data Needed for Analyzing Project Applications

The following are examples of key data that are typically used for analyzing flood and earthquake hazard mitigation projects:

<i>Type of Information</i>	<i>Flood Project Data and Source</i>	<i>Earthquake Project Data and Source</i>
Hazard Data (often not included in application)	Flood Insurance Study (FIS) data, or historical flood data from application.	Seismic hazard data from a credible source
First Floor Elevation	Is this available from engineering surveys or can it be estimated from observed flood depths?	Not applicable
Scope	What problem does the project address? How vulnerable is the building, item, or area?	Same as flood
Cost	Is there a well-documented cost estimate or only a rough estimate?	Same as flood
Useful Lifetime	How long will the project provide protection (mitigation) against damages and losses?	Same as flood
Economic Considerations	What is the square footage of the building? What are the replacement values of the building (or other facility) and contents?	Same as flood
Occupancy	Not usually applicable.	What are the levels of occupancy and visitors during various times throughout the day?
Function	What is the function of the facility and is it entirely or partially related to emergency response and recovery?	Same as flood
Structure Type (if a building)	Number of stories Square footage General condition Basement	Construction type (wood frame, steel, masonry) Level of seismic design, if known # stories Occupancy
If a "service" such as electrical substation, road, water utility	What are the volume and unit of service provided and the cost, if known.	What are the volume and unit of service provided and the cost, if known.
Project Performance	Describe extent to which project protects the buildings (i.e., number of feet elevated or protects to 100-year flood).	Describe level of seismic design, define fragility after project, or note event to which project protects (i.e., 100-year earthquake).



Job Aid 9-1